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(54) **SURFACE TREATMENT METHOD OF QUICKLIME POWDER**

SPECIFICATION

1. TITLE OF THE INVENTION

Surface Treatment Method of Quicklime Powder

2. CLAIMS

1. A surface treatment method of quicklime powder characterized by coating quicklime powder with a compound of one or two or more types of substances selected from stearic acid, stearyl alcohol, paraffin, an ethylene-vinyl acetate copolymer, and a polyester.

3. DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to a surface treatment method of quicklime powder comprising coating the surface of particles of quicklime powder by a specific substance to give fluidity and moisture-proofness to quicklime powder.

Quicklime has an inherently high reactivity and absorbs moisture in the air to change to slaked lime and has the property of increasing in aggregation, so obstructs handling at the time of storage, shipment, and conveyance. Further, when crushing quicklime to a powder, the absorption of moisture and aggregation are aggravated, so in the past, rather than a powder form, clumps of quicklime have been used. Recently, from

the viewpoint of new technology and energy conservation such as with blowing quicklime into molten pig iron as pretreatment for converter steelmaking in the steelmaking field, the use of the slaking heat at the time of production of lime milk in the chemical field, etc., use of inexpensive powder of quicklime has been demanded. However, as explained above, at the current time that use is hindered due to the instability of quicklime powder such as explained above.

The inventors engaged in intensive studies on a method of treatment of quicklime able to meet the above demands and as a result discovered that by coating quicklime by one or more substances selected from the group comprised of stearic acid, stearyl alcohol, paraffin, an ethylene-vinyl acetate copolymer, and a polyester, the absorption of moisture and aggregation during storage can be suppressed, the fluidity during transport can be improved, and when necessary the reactivity can be easily restored, and thereby completed the present invention.

In the method of the present invention, the specific compound is preferably used coated in the state dissolved in a suitable solvent to form a solution. As a suitable solvent, for example, toluene, n-hexane, ethylene chloride, etc. may be mentioned. One or more among these is used. The amount of the compound used for the coating differs depending on the type of the compound, but normally is 0.5 to 5.0% (wt% with respect to quicklime powder, same below), preferably 0.5 to 2.0%, if less than 0.5%, the desired fluidity and moisture-proofness cannot be obtained, while if over 5.0%, no improvement in effect comparable with the amount used can be seen. Sometimes a detrimental effect is caused in reactivation.

A preferable mode of the surface treatment method of the present invention is to first add and mix a solution, obtained by dissolving one or more types of said specific compound in said solvent, into quicklime powder right after crushing by charging, spraying, or immersion, sufficiently stir the result, then allow it to stand or, if necessary, heat it somewhat to cause the solvent to evaporate and the result to dry.

The thus obtained surface-treated quicklime powder has an excellent fluidity and is superior in moisture-proofness, so will not spoil or absorb moisture and agglomerate at the time of storage and transport/conveyance, so is extremely easy to handle.

The surface-treated quicklime powder obtained according to the present invention can be returned to the inherent activity of quicklime by for example heating at any time. The temperature required for reactivation is at least 300°C. For example, if heated at about 400°C for 10 minutes, the inherent activity can be sufficiently restored.

Next, examples will be given to explain the method of the present invention.

Example 1

6 liter solutions comprised of 5 g, 20 g, and 30 g of stearic acid dissolved in toluene were prepared and added to 1 kg amounts of quicklime powder obtained by crushing clumps of quicklime. The results were sufficiently mixed, then allowed to stand for about 5 hours to naturally dry and obtain three types of, that is, 0.5%, 2%, and 3%, surface-treated quicklime powder.

Examples 2 to 4

Except for using stearyl alcohol (Example 2), an ethylene-vinyl acetate copolymer (Example 3), and polyester (Example 4) instead of stearic acid, the same procedure was performed as in Example 1 to prepare a toluene solution and treat quicklime powder by these solutions so as to obtain 0.5%, 2%, and 3% surface-treated quicklime powder.

Example 5

Except for using a mixture of stearic acid and paraffin (weight ratio 1:3) instead of stearic acid, the same procedure was performed as in Example 1 to prepare a toluene solution and treat quicklime powder by that solution so as to obtain surface-treated quicklime powder.

Next, the surface-treated quicklime powder obtained at the above Examples 1 to 5 were investigated for fluidity, moisture-proofness, and degree of activity. Note that as the samples, use was made of 16 mesh pass surface-treated quicklime powder.

(Fluidity)

The fluidity was evaluated by measuring the angle of repose. The samples used were ones right after surface treatment. The results are shown in Table 1.

Note that the angle of repose of the untreated quicklime powder (16 mesh pass) after crushing was 45.0 degrees.

Table 1

Ex. no.	Amount of compound (%)		
	0.5	2	3
1	42.0	32.5	33.7
2	39.5	35.0	34.2
3	40.3	35.0	32.8
4	38.8	36.5	35.2
5	40.0	39.5	35.9

As clear from Table 1, as the amount of the compound becomes larger, the angle of repose becomes smaller and the fluidity increases. Usually, powder having an angle of repose of not more than 40 degree can be transported by a pipeline.

(Moisture-proofness)

20 g amounts of surface-treated quicklime powder obtained in Examples 1 to 5 and 20 g of untreated quicklime powder serving as a comparative example were allowed to stand while spread in the air to thicknesses of about 2 to 4 mm and measured for weight every 24 hours. The weathering rates were found by the following formula. The results are shown in Table 2 (case of 3%), Table 3 (case of 2%), and Table 4 (case of 0.5%):

Weathering rate (%) = (b-a)/a x 100

a: Weight of sample at start (g)

b: Weight of sample when measured (g)

Table 2

Ex. no.	Weathering rate (%)				
	After 1 day	After 2 days	After 3 days	After 4 days	After 5 days
1	2.9	5.7	9.2	13.6	17.5
2	2.9	5.6	8.6	12.5	16.0
3	2.8	5.4	8.8	13.1	16.8
4	2.5	4.8	7.5	12.4	14.5
5	2.7	5.2	8.0	12.2	15.6
Comp. ex.	6.0	10.7	14.2	17.8	20.6

Table 3

Ex. no.	Weathering rate (%)				
	After 1 day	After 2 days	After 3 days	After 4 days	After 5 days
1	2.9	5.8	9.8	13.0	16.6
2	3.1	6.0	9.9	13.1	16.8
3	2.9	5.6	9.4	12.6	16.0
4	2.7	5.5	9.3	12.5	15.9
5	2.9	5.6	9.1	12.1	15.3

Table 4

Ex. no.	Weathering rate (%)				
	After 1 day	After 2 days	After 3 days	After 4 days	After 5 days
1	3.6	7.0	10.9	14.2	17.4
2	3.7	7.6	10.5	13.8	17.2
3	3.6	7.6	10.6	13.8	17.1
4	3.7	7.9	10.9	14.2	17.5
5	3.7	7.5	10.3	13.4	16.7

(Reactivation)

The degrees of activity of lime powder (0.5% and 3% ones) and untreated quicklime powder were measured by coarse grain titration using 4N-HCl. The results are shown in FIG. 1 (case of 3%) and FIG. 2 (case of 0.5%).

As clear from FIGS. 1 to 2, the surface-treated quicklime powder obtained from the method of the present invention is sufficiently suppressed in its activity. In particular, when using stearic acid (Example 1) and a mixture of stearic acid and paraffin (Example 5), the action in suppressing activity is remarkable.

Next, the samples for which the inherent activity is to be restored (3% ones) were heated in an electrical furnace at 400°C for 10 minutes and measured for degree of activity by coarse grain titration. The results are shown in FIG. 3.

As clear from FIG. 3, it is learned that the degrees of activity of untreated quicklime powder are returned to.

4. BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1 to 2 are graphs of changes along with time in the degree of activity of surface-treated quicklime powder given in Examples 1 to 5 and untreated quicklime powder, while FIG. 3 is a graph of the changes along with time in the degree of activity after heating of the surface-treated quicklime powder given in Examples 1 to 5.

FIG. 1

COMPARATIVE EXAMPLE

EX. 1

EX. 2

EX. 3

EX. 4

EX. 5

4N-HCl CONSUMPTION

TIME (MIN)

FIG. 2

COMPARATIVE EXAMPLE

EX. 1

EX. 2

EX. 3

EX. 4

EX. 5

4N-HCl CONSUMPTION

TIME (MIN)

FIG. 3

EX. 1

EX. 2

EX. 3

EX. 4

EX. 5

4N-HCl CONSUMPTION

TIME (MIN)

Fig. 1
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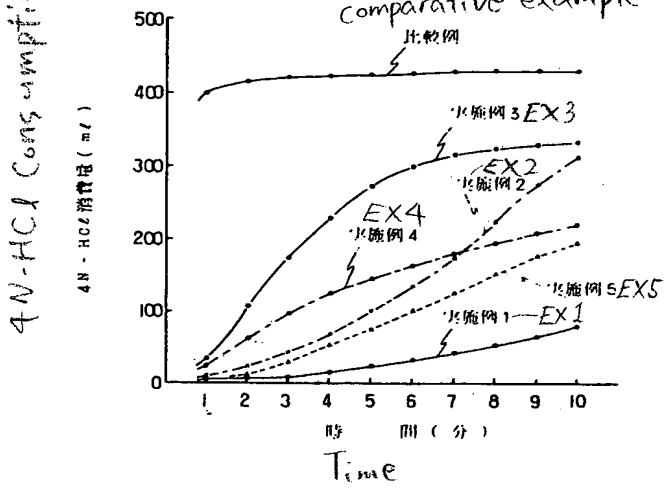

Fig. 2
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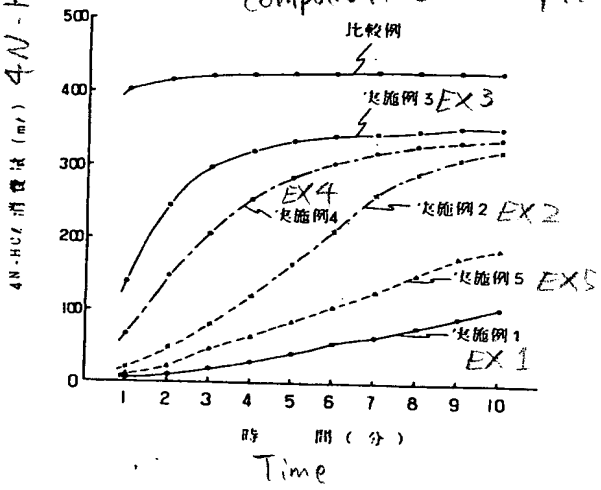

Fig. 3
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